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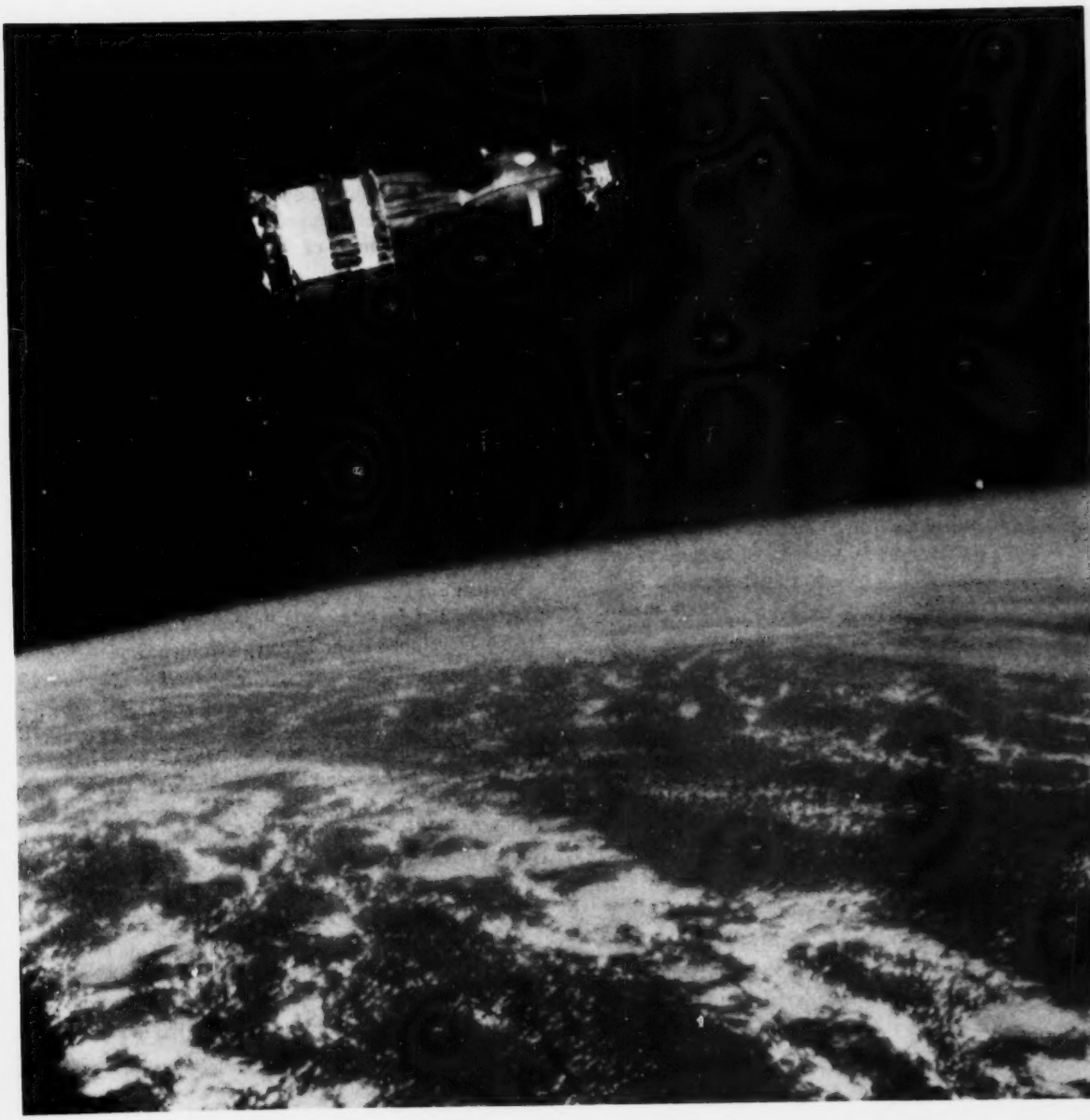

COVER

This scene photographed with a handheld 70-millimeter camera from a rendezvous window of the American Apollo spacecraft during the ASTP mission shows the Soviet Soyuz spacecraft contrasted against a black-sky background, with the Earth's horizon below.

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Monthly NASA Highlights

Viking Spacecraft on 11-Month Journey

The two Viking spacecraft launched during August will take about 11 months to reach Martian orbit. The Viking A mission could land on the surface of the planet on July 4, 1976.

The Viking Project is designed to advance the knowledge of the planet Mars by observations from Martian orbit and direct measurements in the atmosphere and on the surface. Particular emphasis will be placed on obtaining biological, chemical and environmental data relevant to the existence of life on the planet at this time, at some time in the past, or the possibility of life existing at a future date.

The two Viking spacecraft each consists of an Orbiter and a Lander. The Viking Orbiters will survey the selected landing sites prior to separation of the Landers. If the Orbiters' instruments indicate that the landing sites are unacceptable, alternate sites will be used. The Orbiters are designed to operate for approximately 144 days in Mars orbit and the Landers to operate serially for approximately 125 days on the surface.

Energy Agreement to Single Out Program Tasks

Under the terms of the interagency cooperative agreement recently signed by the Energy Research and Development Administration (ERDA) and NASA, its main purpose being to intensify the national effort in energy research and development, management of the two agencies will identify specific program tasks that can be undertaken by the NASA Centers in support of ERDA programs.

NASA has the capability for supporting the national energy R&D effort with its engineering and scientific personnel, extensive research facilities, and proven management techniques and procedures. These will be used for basic and applied research, for specific technology developments, and for technical and administrative support.

An ERDA-NASA Program Coordination Committee will meet quarterly to review the scope of NASA support for ERDA programs and annually review NASA's R&D work in support of ERDA.

Largest Infrared Telescope to Be Constructed on Mauna Kea

NASA has awarded a contract for the construction of an infrared telescope facility nearly 14,000 feet above sea level on the summit of Mauna Kea, Hawaii's highest mountain. The contract, awarded to the University of Hawaii, covers the design, construction, installation and assembly of the facility. When completed in mid-1977, the 120-inch IR 'scope will be world's largest.

The facility will provide supporting and complementary data to NASA's planetary exploration programs, particularly the Mariner mission to Jupiter and Saturn scheduled for 1977. It will also provide a national capability for ground-based observatories of astronomical objects in the middle and far infrared portion of the electromagnetic spectrum.

The telescope will be a nationally available facility operated for NASA by the University of Hawaii, under the direction of Dr. William Brunk, NASA Chief of Planetary Astronomy.

Wallops: America's Rocket Capital

Senator Harry F. Byrd, Jr., of Virginia commented on the important role Wallops Island plays in space research efforts during the current Senate session. In saluting the men and women of Wallops Flight Center who have made a major contribution to the nation's achievements in space, he referred to WFC as the "rocket capital of the United States."

Most of the launches from Wallops are one and two-stage rockets carrying instruments for atmospheric tests. Since the center opened in 1945, nearly 14,000 rockets have been launched; 640 of these were sent into space.

The Wallops facility was on standby status during the Apollo Soyuz Test Project (ASTP) flight with the responsibility of pushing the "abort" button, upon orders from Cape Canaveral, should an anomaly occur during the Apollo launch phase. It was also scheduled to track the vehicle from 400 seconds after liftoff to six hours into the flight, but was relieved after 15 minutes because everything went so well.

Advanced Bearing Technology

Ask any 10 persons what are the major components of a modern jet engine—even knowledgeable airline or engineering individuals—and invariably the answer will be compressors, turbines, fans, or combustors. Nearly

without exception, bearings never are mentioned as a major component. Yet modern high performance military and commercial jet engines would be an impossible dream were it not for high speed ball bearings, developed as a result of the pioneering research performed by the Lewis Research Center under the Aeronautical Propulsion Program of the Office of Aeronautics and Space Technology.

The key problem was to develop bearings that would last a long time in service. A ball bearing's durability is affected by the speed, load, and temperature of the operation of the engine. As recently as 10 years ago, bearings available at that time would have operated reliably for only about one year under conditions existing in a present-day jet engine.

Through the joint efforts of industry and the Lewis Research Center, the basic factors affecting bearing life were determined. These factors turned out to be good lubrication, careful control of material composition, and accuracy in manufacture. Application of these requirements to the bearing design resulted in the advanced technology ball bearing. This ball bearing has a life of at least 10 years. High lifetime means safer and more reliable engines and potential reduction in operating costs.

The technology behind these bearings is equally applicable to any bearings required to operate reliably at high speed, under heavy loads, and at high temperatures. Examples are engines for high speed ground transportation, electric power generators, and synthetic fuel plants.

Hydrogen Enrichment for Light Aircraft Engines

Two of the most pressing problems facing the light aircraft industry today may both be eased by a single NASA research program. Reduced fuel consumption and a significant reduction in exhaust pollution for general aviation reciprocating (piston) engines are the objectives of the new NASA technology program. Managed by the Jet Propulsion Laboratory for the Civil Aircraft Program of the Office of Aeronautics and Space Technology, the efforts involve the use of hydrogen to enrich gasoline.

A small amount of gaseous hydrogen injected with the fuel and air mixture used by internal combustion engines modifies the combustion characteristics in a substantial and beneficial way. With the hydrogen enrichment, combustion can be sustained at much leaner mixtures than is possible with only gasoline and air. The engine operates at high efficiency, burning less fuel for the same horsepower. The net result is a reduction in exhaust pollutants and lower fuel consumption during cruise flight.

One of the important keys to the success of this concept is the catalytic hydrogen generator. Using aviation gasoline from the same tanks as the engine, the generator decomposes the liquid into a hydrogen-rich gas that is then delivered to the engine to modify the combustion process.

The basic concept and the efficiency of the generator have been demonstrated in ground tests using automobile engines. Now the unique safety considerations and very stringent operating conditions of the air-cooled aircraft piston engine are being studied under the present program. The system definition phase of the program has just been completed. This will be followed by fabrication, ground testing and simulation and, finally, flight testing during the next two years.

Aircraft Noise Reduction Flight Procedures Tested

A new flight procedure, called the "two-segment approach," reduces substantially the ground level noise of landing commercial aircraft. Two-segment landing approach procedures and related equipment were developed by Ames Research Center in cooperation with the Federal Aviation Administration, the airlines, pilot associations and a leading manufacturer of electronics equipment.

In a two-segment, noise-abatement approach to landing, the aircraft descends along a slightly steeper-than-normal path during the first part of the approach until it reaches an altitude of approximately 1,000 feet. At that point, the approach is made shallower to conform to the normal glide path which the aircraft follows to landing. Ground level noise is reduced because less engine power is required during the initial phase of its landing approach.

Two concepts of a computer-calculated upper segment glide path were evaluated in two aircraft. The first aircraft was a Boeing 727, most widely used short-to-medium range commercial aircraft. The second was a DC-8, selected because its clean aerodynamic design offered the greatest challenge in adapting to a two-segment approach.

In addition to hundreds of hours of simulator flying devoted to determining safety and operational feasibility, more than 200 pilots from airlines, pilot associations, government, and aircraft manufacturers have flown and evaluated over 2,300 two-segment approaches at 19 airports. A two-segment approach using electronic guidance equipment has been demonstrated to be both safe and operationally acceptable, while providing significant noise reduction during landing approach.

NASA has completed its program of research on the two-segment landing approach. The FAA is now considering this potential noise-reduction procedure, and further actions depend on the decisions of that agency.

NASA Assists FAA Microwave Landing System Program

In 1971, the U.S. adopted a national plan and proceeded with development of a Microwave Landing System (MLS) for aircraft to be the successor to the present U.S. (and international standard) instrument landing system (ILS). This plan was developed jointly by the Department of Transportation (DOT), Department of Defense (DOD), and NASA. Overall management of the MLS program is by the DOT Federal Aviation Administration (FAA). The U.S. MLS effort is coordinated with the International Civil Aviation Organization (ICAO) program for international standardization of a new precision approach and landing guidance system; system selection by ICAO is expected in 1976.

The most promising MLS approaches using two different techniques were the Conventional Scanning Beam and the Doppler Scan. These two candidate techniques were selected for further development in a feasibility demonstration program.

Competing contractors provided four systems for evaluation, two for each of the two candidate techniques. One system for each technique was installed at Wallops Flight Center (WFC) and at FAA's National Aviation Facilities Experimental Center (NAFEC). The Langley Research Center C-54 and an Air Force C-131 operated by WFC were part of the evaluating aircraft fleet. As a result of these tests, the U.S. selected the Time Reference Scanning Beam (TRSB) technique as its candidate for the ICAO program.

Support is continuing by Langley and Ames Research Centers. At LaRC, MLS airborne antenna locations and signal polarization are being investigated. FAA and Center personnel are working on a plan for NASA's Terminal Configured Vehicle Program B-737 to provide data and MLS flight demonstrations for the ICAO All-Weather Operational Panel with the TRSB system next spring as part of the prototype development program.

The Office of Aeronautics and Space Technology, Aeronautical Operating Systems Division's program now underway includes MLS as an approach and landing guidance system in simulations and flight research for conventional takeoff and landing (CTOL) and V/STOL aircraft. Initial installation is anticipated in the late 1970s.

The MLA will provide more accurate signals under all siting conditions and a wider range of capabilities not provided in the present ILS.

UN Outer Space Committee Meeting

The 1975 session of the UN Committee on Peaceful Uses of Outer Space met at the United Nations Headquarters in New York recently. The Committee reviewed reports from its Legal Subcommittee and its Scientific and Technical Subcommittee, including work on legal and organizational aspects of remote sensing of the Earth, consideration of principles related to direct broadcasting by satellite, formulation of a treaty on the Moon and other celestial bodies, discussion of the demarcation of outer space, and review of the UN 1976 program dealing with space applications. Noting progress made in each of these areas, the Committee formed its report to the General Assembly and recommended continued effort next year in the work areas identified above.

Ambassador W. Tapley Bennett was the U.S. representative; with Stephen E. Doyle, Deputy Assistant Administrator for International Affairs, NASA, Ronald Stowe, Assistant Legal Adviser, Department of State, and Richard Long, Bureau of International Organization Affairs, Department of State, serving as alternate representatives. Neil Hosenball, General Counsel for NASA, served as a U.S. delegate, and NASA Staff Attorneys Pierre Hartman and Gerald Patterson as informal advisors to the U.S. delegation. ■

New Tracking Station Deputy—*Fidel R. Rul, Jr., shown seated at his desk, recently was appointed Deputy Director of the Goldstone Tracking Station near Barstow, CA, marking the first time a Spanish-American has been assigned to the Tracking Station Management Team. Since 1963, when he came to work for NASA, he has been involved in some aspect of the Spaceflight Tracking and Data Network operations in support of the manned space programs (Gemini, Apollo, Skylab and ASTP), putting in service at both the Johnson Space Center and the Goddard Space Flight Center.*

Viking to Conduct 13 Mars Investigations

Both Landers and Orbiters Will Participate in Most Ambitious Unmanned Exploration

Thirteen specific investigations, to be performed by scientific instruments aboard the Orbiters as they circle Mars and on the Landers as they sit on the surface, will be made of that planet by the Viking mission that began this month with separate launches of two spacecraft, each consisting of an Orbiter and a Lander.

Dedicated to the scientific study of Mars and involving the most ambitious unmanned planetary exploration ever attempted, the mission will begin sending back data during July, 1976, that will be processed by scientists at the Jet Propulsion Laboratory's Image Processing Laboratory (IPL).

Three investigations will be carried out by each Orbiter: Imaging, Atmospheric Water Vapor, and Thermal Mapper. They will be performed by instruments mounted on a scanning platform that will enable each to view the same area of the planet at the same time.

The Imaging investigation will send to Earth high-resolution, contiguous pictures of the Mars surface. The swath of pictures will cover an area 40 kilometers (25 miles) wide by several hundred kilometers in length. The high resolution (40 meters, or 125 feet) will permit seeing objects about the size of a football field. The pictures will be used for detailed topographic study of the surface and will be of extreme importance in examining the preselected Viking landing sites for safety as well as for scientific interest.

A pair of vidicon cameras will take the pictures from a height of 1,500 kilometers (937.5 miles) as each spacecraft flies over the landing sites. By moving the scan platform, pictures also can be taken to the side, forward or backward. The cameras have color filters.

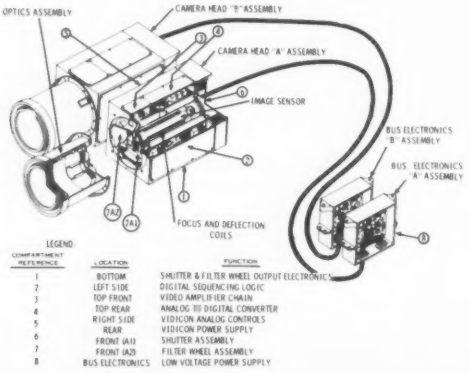
The Atmospheric Water Mapping investigation is intended to examine the humidity in the atmosphere, its distribution and changes. The instrument uses an infrared spectrometer to measure the amount of water between the spacecraft and the surface. Because Mars is thought to be very dry, the sensitive instrument will measure water in the atmosphere down to the level of one "precipitable micron." (This means that, if all of the water in the column of atmosphere between the instrument and the surface were to be condensed as liquid, it would be only one millionth of a meter thick.)

Because water is probably the most important ingredient in the formation of life and is known to be present in small amounts in the Mars atmosphere, a detailed water map of the planet is considered essential to understanding the planet. The water map will also be used when selecting the final landing sites.

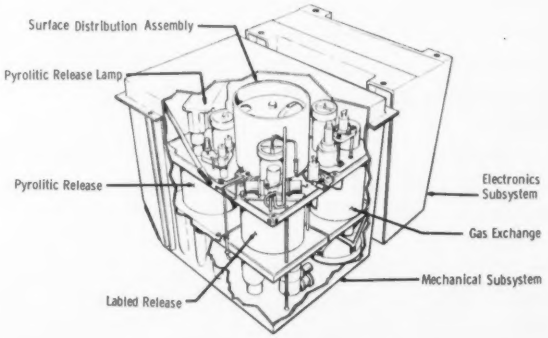
The Thermal Mapper study will obtain a detailed map of the temperature of the Mars surface. Using an infrared radiometer, the Orbiter can sweep over an area and generate a fairly detailed map of the surface thermal conditions. Data will be used to help understand the processes taking place at the surface, and will be used to determine the general surface characteristics (e.g., its radiative qualities and the surface roughness). This experiment will also contribute to final selection of the landing sites.

One atmospheric experiment will be done while each Lander is entering Mars' atmosphere. It is the Entry Science investigation, which will measure atmospheric chemical compositions and physical nature during the entry. The charged particles, ions and electrons of the

Two facsimile-type cameras mounted on the surface of the Lander can scan all the way around to take 360 degrees panoramic pictures of the area surrounding the landing site. Built with a mechanical scanning mirror, the camera catches each single scan-line imaged by nodding the mirror. The next line is formed by rotating the camera in azimuth.


OPTICS ASSEMBLY
CAMERA HEAD "B" ASSEMBLY
CAMERA HEAD "A" ASSEMBLY
IMAGE SENSOR
BUS ELECTRONICS "B" ASSEMBLY
BUS ELECTRONICS "A" ASSEMBLY
FOCUS AND DEFLECTION COILS
LEGEND:
COMPARTMENT REFERENCE
LOCATION
FUNCTION
1 BOTTOM SHUTTER & FILTER WHEEL OUTPUT ELECTRONICS
2 LEFT SIDE DIGITAL SEQUENCING LOGIC
3 TOP FRONT VIDEO AMPLIFIER CHAIN
4 TOP REAR ANALOG TO DIGITAL CONVERTER
5 RIGHT SIDE VIDICON ANALOG CONTROLS
6 REAR VIDICON POWER SUPPLY
7 FRONT (A1) SHUTTER ASSEMBLY
FRONT (A2) FILTER WHEEL ASSEMBLY
8 BUS ELECTRONICS LOW VOLTAGE POWER SUPPLY

In Quest of Life —*Three biology experiments will be performed to search for the presence of organisms on Mars' surface. Three complete laboratories are housed in a container about one cubic foot in volume and weighing only 35 pounds. The instrument is a remarkable engineering achievement consisting of over 40,000 parts. Each of the experiments will test a few grams of soil scooped from the surface by a retractable 10 foot arm.*



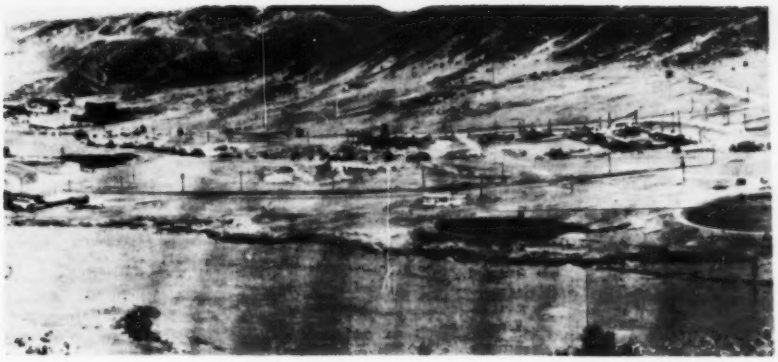


Photo by Viking Camera—*This picture is a mosaic assembled from several photographs taken with the Viking '75 Lander Camera during a period of science testing in June, 1974, from a site overlooking the Martin Marietta Denver facility. Each Lander on the spacecraft will be equipped with two cameras identical in design and performance to the one used in this instance.*

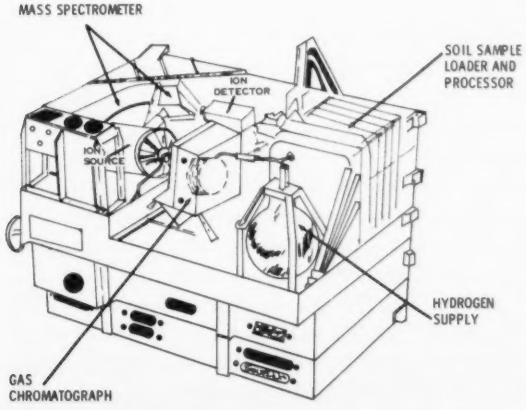
upper atmosphere are measured with a retarding potential analyzer when the Lander is several hundred kilometers from the surface.

The chemistry of the gases will be measured with a small mass spectrometer (range 1-50) down to 20 kilometers (12½ miles). Temperature and pressure sensors will measure the lower atmosphere in the last few kilometers when the Lander is on its parachute. Accelerometer data will be used to help reconstruct the atmosphere profile.

Each Lander has eight experiments, led by the Lander Imaging system, the most general, yet useful, investigation. The cameras are two facsimile-type devices mounted one meter above the surface. Each camera can scan 360 degrees to get a panoramic view from the base of the Lander to 60 degrees above the horizon.

Using the two cameras simultaneously makes possible stereoscopic images, and will determine the distance and shape of objects in the field of view. The cameras also have color filters to make some chemical mineralogy investigations of the surface near the Lander.

The Pride of Engineers and Scientists—*The GCMS (gas chromatograph-mass spectrometer) is another ultra-complex, super-miniaturized instrument that will use oil samples to determine the organic compounds on Mars and components of the Martian atmosphere.*



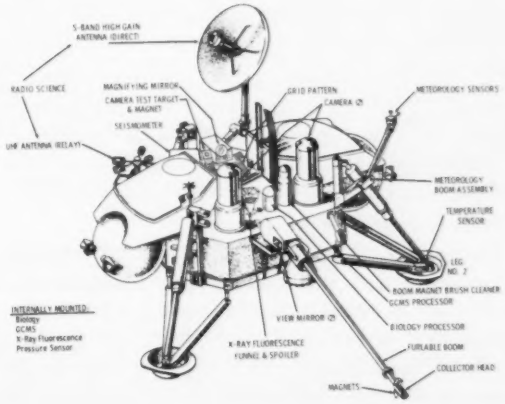
The cameras can be used in a special "line scanning" mode to detect motions and to determine the star field. They can also be used as a photometer to measure the degree of illumination. The cameras' usefulness, besides identifying the local terrain, will be to help conduct two other investigations of magnetic and physical properties.

One of the most important experiments on Viking is the search for extra-terrestrial life. Scientists disagree about the probability that life has evolved on Mars, but almost all scientists believe that the "discovery of life on Mars would be the find of the century."

There is no simple, universal test for discovering life. To cover a wide range of possibilities, there are three different experiments combined in the miniaturized biological laboratory within the Viking Landers. All tests will be performed on small soil samples (a few grams) scooped from the surface by the 10-foot-long retractable arm.

The Pyrolytic Release experiment is a test for photosynthesis. No water will be added in this experiment so that conditions will be very arid as it is on Mars. The

Each Lander carries eight investigations. Each of these investigations are sequenced in order to maximize the scientific data return and to make the data of one experiment determine the command and performance of others.



test is for the conversion of carbon dioxide into organic material in the presence of light.

In the Gas Exchange experiment, a rich nutrient is added to the soil sample and monitored for several weeks to detect growth. This will be measured by gases released into the test cell by the growing culture. The nutrient contains a variety of substances known to support Earth life, such as amino acids and sugars.

The Labeled Release experiment is a very sensitive "tracer" test to see if metabolism can be detected. A few drops of a very diluted medium containing a radioisotopic tracer are added to the soil sample. This tracer technique is well established for detecting a few hundred bacteria in a terrestrial soil sample. It has been tested in Antarctica.

Each of these experiments will be used to test three samples from different places around the Lander. Each has an appropriate "control experiment" to verify the finding.

The instrument to make the biology investigation is a remarkable engineering achievement. It contains more than 40,000 parts, including a variety of systems such as test cells, optics, heaters and coolers, isotopic detectors, a gas chromatograph, ampholes of fluid, measuring devices, and a complex electronic system for turning things on and off, making measurements and controlling events. All of this equipment has been packaged into one cubic foot and weighs only 35 pounds.

There are two chemical analysis experiments conducted on the Lander. These require samples of soil that are delivered by the sampling arm and its scoop. One of these is an Organic Analysis and the other an Inorganic Analysis.

The Molecular Analysis investigation will determine and characterize the organic compounds on Mars. It uses a Gas Chromatograph/Mass Spectrometer (GCMS). A small 100-milligram soil sample is placed in an oven and heated to 500 degrees Centigrade in steps to drive off volatile gaseous substances, which are separated by a tenex gas chromatograph column and analyzed by a sensitive Mass Spectrometer.

The GCMS instrument can detect amounts as small as one part per million of organic compounds. The same Mass Spectrometer will be used to determine the components of the Martian atmosphere. This investigation is important as a corroboration of the biology experiments.

Inorganic Analysis is done to determine the elemental composition of the surface. From this information it may be possible to postulate the mineralogy of Mars. The analysis is done with an X-ray Fluorescence Spectrometer that irradiates a sample with X-rays and measures the fluorescing X-rays with a proportional counter. It can analyze 10 different samples from the surface.

The next investigation will study the climatic conditions of Mars through a large part of its summer season. This will be done with a set of sensors mounted at the end of a boom to avoid interference from the Lander. Measurements will be made of pressure, temperature, wind speed and wind direction.

By studying the conditions for daily and seasonal changes, meteorologists believe they will be able to better understand the weather formation processes on Mars. This information should be extremely useful in helping understand the more complex weather elements on Earth.

A Seismology investigation will also be conducted by the Landers. From Mariner spacecraft data, scientists have discovered that the Martian surface is undergoing fast changes. The detection of surface movement or internal disruption, as evidenced by Martian quakes, would contribute greatly to understanding the history of the planet.

A small, three-axis seismometer on the Lander will detect very faint "Marsquakes." With two instruments, one on each Lander, at different locations on the planet, the epicenter of a major seismic event should be located if it takes place while the Landers are on the surface.

In a Magnetic Properties investigation, a small magnet will be brushed along the surface and held in front of the cameras to see if any magnetic particles cling to the magnet. This will reveal the state or condition of surface material. (The magnet is attached to the back of the scoop at the end of the sampler arm.)

For a Physical Properties investigation, the camera will take pictures of the Lander's footpad, a mirror that views beneath the Lander and a stroke gauge on the Lander legs. These will be used to assess the planet's physical characteristics such as hardness of the surface.

A Radio Science investigation will make careful use of the telecommunications system between the spacecraft and Earth. By studying changes in radio strength and frequency, many things about the planet can be determined. This includes atmospheric ionization, gravitational anomalies and certain solar influences that would help in understanding the theory of relativity.

Data from the Radio Science will also be used to determine the exact location of the Lander on Mars. The celestial determination of the ephemeris (location of the planet) can also be made through these data.

Data from these scientific investigations will be compared with those gathered about the Earth, and more will be learned about the structure and dynamics of atmosphere. From this new knowledge, scientists will be seeking ways to predict and possibly prevent changes in climate and environment that threaten man with such disasters as earthquakes, drought and floods.

Readying for Shuttle—*An artist depicts new facilities planned at Flight Research Center in support of the Space Shuttle. The 100-foot-high structure at right will be used to mate and demate the Orbiter to the 747 aircraft which will be used to launch it for approach and landing tests beginning there in early 1977. The 25,000-square-foot hangar in the center will aid with maintenance. Both later will serve a purpose during the recovery operations of the Shuttle from the initial manned orbital flights.*

GSFC Scientist Suggests Cosmic Ray Source

Dr. Floyd W. Stecker

A 75-year-old mystery and a basic problem in physics for decades, the origin of cosmic rays, apparently has been solved by a NASA scientist, Dr. Floyd W. Stecker of the Goddard Space Flight Center.

In an article published July 21 in "Physical Review Letters," the prestigious scientific journal of the American Physical Society, Stecker says these most energetic particles in the universe (up to a billion times as energetic as can be duplicated in the laboratory) almost certainly come from supernovae, exploding stars in the Earth's galaxy.

The effect of cosmic radiation on human tissues has been a concern of life sciences investigators for a number of years. Astronauts have reported seeing light flashes as the cosmic rays penetrated eye retina cells. It is estimated that a two-year manned mission to Mars would result in 10 percent of all body cells being struck by these particles. Recent studies have shown that they can kill living cells if they pass close enough to the cell's nuclei.

The origin of this mysterious radiation has intrigued many internationally-known physicists, including Enrico Fermi, the atomic energy pioneer, who speculated in 1949 that these particles traveling at about the speed of light, or 186,000 miles per second, are accelerated by weak magnetic fields in interstellar space. Others thought they might come from sources outside the Milky Way, such as radio galaxies and quasars. In 1912, the German physicist, Victor F. Hess, established from a series of balloon flights that this radiation increased with altitude and thus probably originated in outer space.

It was found that the energy of this radiation greatly exceeded that of known radiation emitted by natural radioactive substances. In the early years, it was thought that cosmic rays were gamma rays which are a highly penetrating form of electromagnetic radiation.

In the 1920s, it was discovered that cosmic rays were less frequent near the equator than at higher latitudes and that they therefore must be charged particles being deflected by the Earth's magnetic field as they approached Earth. This conclusively established that these particles

Getting Ready for the Shuttle—*Todd Groo (left), NASA Asociate Administrator for Center Operations, and Dr. David R. Scott, Director of the Flight Research Center, break ground for the new 25,000-square-foot hangar to be built there for use in connection with the Space Shuttle. Approach and landing tests of the spacecraft will be conducted at FRC in early 1977.*

were charged particles of cosmic origin. But what was producing them?

The war years brought cosmic ray investigations to a standstill, but immediately afterwards and during the 1950s the new field of radio astronomy and rapid development of new experimental techniques and instrumentation added important clues to their origin, with supernovae considered a likely source as first theorized back in the early 1930s.

With the space age, direct measurements of cosmic ray intensity became possible near Earth and in interplanetary space.

However, it wasn't until the launch of GSFC's Small Astronomy Satellite-2 (SAS-2) or Explorer 48 in 1972 that Stecker got the additional information he needed to complement ground-based radio astronomy data.

Members of the SAS-2 scientific team at Goddard, headed by Dr. Carl Fichtel, measured a large amount of gamma rays coming from the Milky Way. They found the most intense gamma radiation comes from directions toward the center of the galaxy, with much less gamma radiation coming from directions away from the galactic center. The detailed SAS-2 data provided Stecker's final clue.

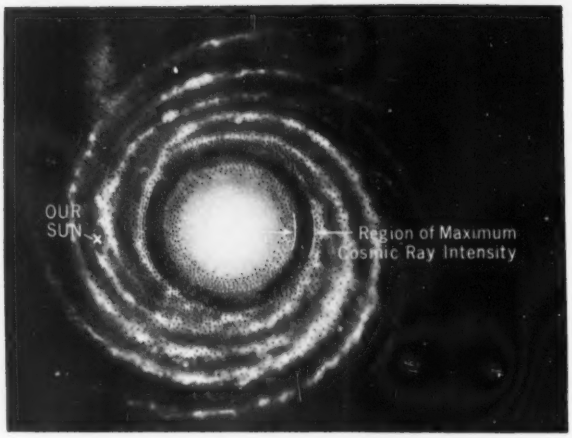
Previously, the big problem was that cosmic rays, being charged particles, could never be traced backward because magnetic fields bounced them around like rubber balls. Gamma rays traveling a straight line are undeterred by magnetic fields. However, they must be observed by satellites orbiting above the Earth's atmosphere.

Here's how Stecker finally put it all together:

First, gamma rays result from collisions of cosmic rays with interstellar gas. Knowing the directions where the gamma rays came from via SAS-2, he was able to pinpoint an area of intense activity located about midway between the galactic center and the Earth. Most of this activity could be shown to be due to large numbers of gas clouds in this region, but it was not enough to account for all the gamma-ray production. This, together with a large drop-off in gamma rays in the outer galaxy, showed cosmic rays are not uniformly distributed throughout the Milky Way. If they had been found to be uniformly distributed, this would have lent support to the theory that cosmic rays come from outside the galaxy.

The area of most intense gamma ray activity is seen by radio telescopes to be a region containing numerous interstellar gas clouds and a large number of supernova remnants. Stecker deduced that cosmic rays are found in the same regions as supernova remnants and in proportion to their number in those regions. It had previously been known that supernova remnants contain high energy electrons and that these exploding stars have enough energy to accelerate the particles.

Interstellar gas is not only the remains of supernovae,



but the makings of new stars. Where there is an abundance of gas clouds, there is an abundance of new stars being formed. Among these are stars 100 times more massive than the Sun which rapidly consume their nuclear fuel and finally blow up, producing a supernova. These stars don't live long enough (about 30 million years as compared to the Earth star's five billion) to get very far from the clouds that form them.

A supernova produces cosmic rays by some yet to be proven means, such as acceleration from the shock waves of the explosion, a dynamo mechanism from a remnant pulsar or electromagnetic acceleration from a remnant neutron star.

"One thing is certain," says Stecker. "We now have very strong, almost conclusive evidence that cosmic rays are produced in the same regions as supernovae which are the only logical galactic events able to produce particles of such energies. The galactic cosmic ray distribution appears to be identical to supernova remnant distribution."

Did You Know?

Farm Girl Mathematician—*Mrs. Jeanette F. Reisz, a red-headed farm girl from Mississippi, is a mathematician in data analysis for the Navigation and Control Systems Branch at the Marshall Space Flight Center. Her programs have been concerned with the Large Space Telescope, High Energy Astronomy Observatory, Multi-Mission Sortie Equipment and other Space Shuttle applications.*

The Goddard Space Flight Center recently participated in a series of experiments to develop techniques for predicting when and where life-threatening tornadoes will strike.

Five Goddard-developed weather satellites, aircraft, radar, and balloons were used in the investigation. The Marshall Space Flight Center, U.S. Air Force, U.S. Army and the National Weather Service were also involved.

Color and infrared monitoring from a NASA twin-engine Beechcraft carrying a wide variety of remote sensing equipment has helped in saving more than two miles of public beach at Kennedy Space Center and in protecting nearby homes. The plane flew over the area every three months, providing color and infrared monitoring from an altitude of 4,800 feet.

When the Saturn 1B launch vehicle blasted off its Florida launch pad on July 15 to send the Apollo Soyuz Test Project vehicle into space, it marked the end of the era during which spacecraft were sent aloft by expendable launch vehicles. Americans will not go into space again until the reusable Shuttle comes into use in 1979.

The Marshall Space Flight Center's program for saving energy has been termed a model effort which could aid others in a report issued by the Federal Energy Administration. It has achieved a 10 percent saving in automotive gasoline, 17 percent in electricity, 85 percent in aviation gas, 46 percent in jet fuel, and 26 percent in diesel fuel.

Moonwatch, the worldwide volunteer satellite tracking network that produced the western world's first observations of Sputnik 1, ceased operations June 30 after nearly two decades of sky patrols. It developed out of the massive scientific endeavor known as the International Geophysical Year (1957-58) and was coordinated by the Smithsonian Astrophysical Observatory with support primarily from NASA.

Flight testing of a low-cost advanced flight control system for general aviation has begun under the direction of the Flight Research Center in a NASA-university-industry program for improved technology. Objectives include improved aircraft ride quality, reduced pilot workload, and improved flight safety.

The U.S. Fish and Wildlife Service and the State of Ohio have recommended a controlled hunt to reduce the burgeoning deer population at Plum Brook Station near Sandusky. Reduction of the herd on the 6,000-acre reservation, estimated at 2,500, with a possibility that it may increase to more than 4,000 by this fall, is necessary to prevent further deterioration of the habitat which may lead to widespread starvation and disease among the animals during the coming winter.

Twenty-five new buses and an $800,000 food-service operation that can serve more than 1,000 customers an hour are being added at the Kennedy Space Center Visitor Information Center to improve the service to the more than 1,000,000 persons who visit there each year.

A unique terrestrial solar energy recording system, or sunfall monitor, was installed recently at the Marshall Space Flight Center. It measures and records solar energy by means of sun tracking and stationary sensors. Two MSFC engineers, Jim Miller and Larry Crabtree, originated the sunfall monitor concept. ■

Balch Announces Retirement Plans

Jackson M. Balch

Henry F. Auter

Jackson M. Balch, who since 1965 has directed the activities of the National Space Technology Laboratories (NSTL), formerly the Mississippi Test Facility (MTF), has announced his plans to retire.

Henry F. Auter, Deputy Manager since 1964, has been named Acting Manager.

Balch became Manager of the MTF during the construction of the $350 million complex and as NASA was beginning its final preparations for activation and readiness to static fire and flight certify the Apollo/Saturn V manned lunar landing rocket boosters. In this capacity, he was a key factor in the testing of the Apollo rockets and Skylab space station rocket boosters.

He continued to direct activities at the installation as the Apollo Program drew to a close and MTF underwent its transition to an environmental and space applications center involving NASA and several federal and state cooperating agencies in research and related activities addressing environmental problems.

Balch has spent his entire career in the federal service. Before accepting his assignment at MTF, he was assistant to Dr. Wernher von Braun, Director of the Marshall Space Flight Center. Earlier, he had been with the Army's Rocket and Guided Missile Agency as Deputy Manager, Research Projects. During World War II, he served in the Army in the Pacific theater. He is a retired brigadier general in the Alabama National Guard.

Auter, a native of Mississippi, was in the Army's Combat Engineers during World War II and was recalled to active duty with the Air Force from 1951 to 1953, during which time he was an Instrumentation Officer at a down-range station of the Eastern Test Range. He is at present a major in the Air Force Reserve (Retired).

Dr. Ness Receives Lindsay Memorial Award

Dr. Norman F. Ness of the Goddard Space Flight Center, a member of the scientific team for Explorer 10, the first spacecraft to measure the Earth's distant magnetic field, has been presented the John C. Lindsay Memorial Award.

This award is given annually to a GSFC employee for an outstanding contribution to science or technology.

Dr. Ness was cited for his pioneering work in the investigation of magnetic fields of planetary bodies and the interaction of the solar wind with these magnetic fields.

As Project Scientist on the Anchored IMP satellites and Principal Investigator for their magnetometer experiments, he was the discoverer of the Earth's magnetic tail and the first to explore the circumlunar magnetic field. These studies culminated in 1974 with his particiation as Principal Investigator for magnetic field experiments on Mariner 10, which flew past Venus and Mercury, and on the Pioneer 11 flyby of Jupiter. The recent third encounter with Mercury confirmed his discovery in 1974 that Mercury has a small, but measurable, intrinsic magnetic field.

Wind Energy Bibliography Published

A wind energy bibliography containing abstracts and special indexes has been compiled for NASA by the Energy Information Center at the University of New Mexico, Albuquerque. Called Wind Energy Utilization, the 496-page volume covers both foreign and domestic sources.

Priced at $10 postpaid in the U.S., the bibliography covers such subjects as wind power plants, wind power generators, wind machines, and wind storage facilities.

The bibliography substantiates that research done during the early years of this century when windmills were employed to generate limited amounts of electricity, as well as present-day developments in aerodynamics, electrical engineering and materials technology, appears to offer significant opportunities for the future.

NASA Employee Awarded Woodrow Wilson Fellowship

Clarence Catoe, Chief of Information Systems in the Guidance, Control and Information Systems Division, Headquarters, has been accepted as a Woodrow Wilson Fellow by Princeton University for the year 1975-76.

The Woodrow Wilson School of Public and International Affairs at Princeton offers the fellowships to a carefully selected group of men and women who intend to follow careers in this field. Catoe was employed by the Goddard Space Center from 1959 until 1967, when he went with the U.S. Coast Guard as a physicist. He returned to NASA in 1972.

Savings Bond Participation up 4.6%

NASA's 1975 Savings Bond Campaign resulted in an agency-wide participation rate of 76.8 percent, an increase of 4.6 percent over last year.

Involved were 1,137 new buyers. One installation, the NASA Pasadena Office, compiled a participation record

1795 SAVINGS BONDS CAMPAIGN RESULTS

Instal-lation	No. of Personnel	New Buyers	Total Bond Buyers	Percent Partici-pation	No. of Bond Increases	Percent Increase in Partic.	Percent of Buyers Increasing	Total Add'l Deductions Per Pay Period
NaPo	35	1	35	100.0	3	2.9	8.8	$ 78.75
NSTL	68	9	63	92.6	13	13.2	24.1	348.50
KSC	2,285	111	2,057	90.0	116	4.8	6.0	4,035.95
LaRC	3,309	149	2,964	89.6	205	4.5	7.3	4,593.36
JSC	3,729	105	3,039	81.5	155	2.8	5.3	4,082.51
FRC	479	34	374	78.1	16	7.1	4.7	596.85
WFC	430	8	326	75.8	13	1.8	4.1	406.88
HQ.	1,566	114	1,177	75.2	135	7.1	12.7	2,941.08
MSFC	4,204	78	3,099	73.7	87	6.1	2.9	2,862.01
LeRC	3,049	77	2,240	73.5	134	6.1	6.2	3,660.15
ARC	1,707	346	1,224	71.7	73	20.3	8.3	4,256.43
GSFC	3,766	105	2,308	61.3	83	2.8	3.8	2,305.28
NASA-WIDE	24,627	1,137	18,906	76.8	1,033	4.6	5.8	$30,167.75
							ANNAUAL DOLLAR INCREASE	$784,361.50

of 100 percent and will receive the Treasury Annual Citation. Four others—National Space Technology Laboratories, Kennedy Space Center, Langley Research Center and Johnson Space Center—had records of more than 80 percent, each earning a Minuteman Flag.

For the seventh consecutive year, employees at KSC participated at a level of 90 percent or higher.

In addition to the new subscribers, 1,033 of those already subscribing increased their payroll allotments. The new and increased deductions will result in additional savings of more than $784,000 a year, for a total saving of more than $14,600,000 by NASA employes.

Pioneer 10 Mystery Solved

The orientation changes in the Pioneer 10 spacecraft reported in the July issue of NASA ACTIVITIES have been found by controllers at the Ames Research Center to be no cause for alarm.

The controllers say these changes were caused by failure of the spacecraft's sensors to remain navigationally "locked" on the proper star. This is the way they explain it:

On May 6, during a routine change in spacecraft orientation required to keep the antenna pointed at Earth, Pioneer's star sensor shifted its "lock" from the star Betelgeuse to Sirius. At the time, the switch was not detected, thus twisting the frame of reference for measuring direction and for changing the direction of spin axis pointing.

As a result, computers in the spacecraft and on Earth indicated a gradual northward shift of the spin axis relative to the Earth's motion around the Sun. Also, when thrusters were fired to move the spin axis with the Earth's east-west course of motion, "southward" impulses were necessary because of the twisted frame of reference.

No loss of data has resulted, according to officials. Techniques are being designed to help verify future correctness of star reference during the infrequent intervals when the star sensor is used.

Pioneer 10, now on its way to the outer reaches of the cosmos, gave the world its first closeup view of Jupiter when it flew past the planet in December, 1973. When it passes the orbit of Pluto in 1987, it will become the first manmade object to escape the solar system.

NASA Aids in Survey of Rooftop Fuel Waste

With NASA support, a midwestern utility company is using an aerial survey technique to measure rooftop heat loss from homes and commercial buildings because of inadequate insulation.

Cengas, the natural-gas distributing division of Central Telephone and Utilities Corp., surveyed five communities in Nebraska and South Dakota on cold, clear nights last winter. Now the company is supplying the results to individual property owners in time for them to add insulation or make roof repairs before next winter.

The survey technique was developed by the Remote Sensing Institute at South Dakota State University, which was aided by the State of South Dakota and NASA's Office of University Affairs.

As the plane made successive runs over strips about three blocks wide, roof surface temperatures were recorded on magnetic tape. Electronic equipment at the Remote Sensing Institute converted the data to strips of film, which was then printed on photographic paper.

In the resulting imagery, called thermograms,

silhouettes of individual buildings can easily be distinguished. Warm roofs appear in light tones and cold roofs in darker tones. Cengas officials estimate that at least 60,000 buildings in the five communities are losing excessive amounts of heat.

Nimbus-6 Weather Satellite Working Well

NASA's meteorological research spacecraft Nimbus-6, carrying the most sophisticated package of meteorological research instruments ever developed, has been checked out in orbit and is working well.

Managed by the Goddard Space Flight Center, it was launched June 12. In addition to returning weather photos of Earth day and night twice a day over every point on the globe, the satellite is transmitting information from free-flying balloons and ocean platforms, making vertical temperature measurements of the atmosphere, observing the amount of solar energy absorbed and reflected by Earth, and mapping liquid water content of clouds and the distribution and variation of sea ice and snow cover.

The data collected by its nine instruments is expected to help in the development of global weather models to help predict weather accurately on a long-range basis.

2 NASA Publications Win Prizes

Two NASA publications—"Our Prodigal Sun" and "NASA and Energy"—were among prize winners at the annual awards banquet of the Federal Editors Association in Washington recently.

"Our Prodigal Sun," an in depth, popularly-presented narrative providing current information about the Sun, won first place in Category 3 for one-color popular publications of 48 or fewer pages.

"NASA and Energy," a pamphlet describing ways in which NASA is helping solve the energy crisis, placed second in Category 1 for one-color foldouts, flyers or leaflets of 16 or fewer pages.

Both publications were prepared by Victor Seigel, Headquarters writer-editor.

Griffin, Allen Get New Assignments

Gerald D. Griffin, NASA Assistant Administrator for Legislative Affairs since April, 1973, has been named to the newly-created post of Deputy Associate Administrator (Operations) in the Office of Manned Space Flight.

He has been succeeded in the Office of Legislative Affairs by Scientist-Astronaut Dr. Joseph P. Allen, currently assigned to the Astronaut Office at Johnson Space Center.

In his new position, Griffin, who served as Flight Director on all 11 Apollo missions, will plan for the most economical and flexible operation of the Space Shuttle and Spacelab.

Dr. Allen was selected as a scientist-astronaut by NASA in August, 1967, and served as mission scientist while a member of the astronaut support crew for Apollo 15. He also has been a staff consultant on science and technology to the President's Council on International Economic Policy.

Tests of Space Shuttle Orbiter Aft Portion Completed

A series of 159 tests of a 0.04-scale model of the aft portion of the Space Shuttle Orbiter configuration 2A were recently completed at the Space Power Facility at Plum Brook Station, Sandusky, OH.

The tests were performed for Rockwell International and the Johnson Space Center to assess the heat transfer and pressure distributions about the Orbiter afterbody surfaces resulting from engine plume recirculation effects and direct plume impingement during second-stage ascent at simulated altitudes ranging from 120,000 to 360,000 feet, with various engine gimbal angles and combinations of Orbital Maneuvering Systems and main engine firings.

The engines were operated with high-pressure hydrogen and oxygen gases at the same nozzle pressure ratio as expected in flight to duplicate exhaust plume configuration. Total run times exceeding 100 meters-per-second were achieved. The large chamber volume (810,000 cubic feet) and achievable wave time made the Space Power Facility ideally suited for the tests.

Fletcher Comments on Importance of Technology

Says It Will Control Standard of Living and America's Place in World Market

Citing that scientific and engineering advances have played a key role in the "remarkable" 199-year history of the United States, Dr. James C. Fletcher, NASA Administrator, cautioned that the technology stemming from these advances will continue as a major factor in determining the nation's standard of living and its ability to compete in the world marketplace.

Reporting he had just returned from a trip abroad during which he had visited the aerospace companies of Europe, particularly in France and Germany, he commented: "It's refreshing, but it's also alarming, because the rest of the world—not only Europe, but Japan and the civilized world generally—is beginning to compete with the United States in all fields of new technology."

"They, in fact," he added, "want what we have—in

FRC Receives German Planes—*These three aircraft formerly belonging to the West German Air Force—a single-seater and two twin-seaters—have been added to the complement of research planes at Flight Research Center. They are F-104G's, a newer version than the F-104A's now in use there and restrained by scarcity of replacement parts. Parts for the F-104G's are expected to be available through the 1980s.*

particular, the progress in space is important to them. They are moving rapidly towards the use of space technology in a good many of their industrial enterprises. Germany at the present time spends more per capita on research and development than the U.S. France is rapidly approaching that."

Dr. Fletcher's comments were made at the dedication of the new Scientific and Technical Information Facility (see the July issue of NASA ACTIVITIES) at Linthicum Heights, MD.

"I think it is of great importance that the world knows that we mean business when we move ahead in research and development," he said. "This facility here today is a symbol of that intention."

Recalling that most people think of NASA as being involved in the rocket, space, aeronautics and satellite business, he said the agency really is in the research business, that everything it does has the objective of acquiring new knowledge and new information that can be used to improve the economy and the quality of life on this planet.

"So in a real sense," he added, "this building symbolizes NASA's mission perhaps more so than a launch gantry or a tracking antenna. This facility houses the operating army of NASA's scientific and technical information system. It is this system that on the one hand acquires the information needed by our scientists and engineers to do their jobs, and on the other hand, documents and disseminates the results of NASA's work to industry, and to the scientific community. In effect, it is a dual system which acts at both the input and the output end of our R&D programs."

He said he had always been fascinated by the great library that existed in Alexandria, Egypt, at the beginning of the Christian era.

"The great library at Alexandria," he continued, "was one of the well known wonders of the ancient world. In its heyday it may have contained as many as 700,000 rolls, perhaps the equivalent of 70,000 books. Up to the time it was destroyed in 47 BC, it was the storehouse of almost all that ancient man had discovered and written down.

"This facility we dedicate today has no such claim to fame and yet it contains a collection of documents that is many times larger than that of Alexandria. In fact, its increase in only one year exceeds the entire Alexandrian collection, and it stands as the world's largest and most comprehensive collection of aerospace scientific and technical information."

OSO-8 Transmits Data for Solar Energy Study

OSO-8, the last in a series of solar observation spacecraft, is transmitting information back to Earth from which scientists are expected to get a better understanding of solar energy transfer in the Sun's atmosphere. In addition, it will continue the 11-year solar cycle study begun with launch of the first OSO in March, 1962.

As this is the minimum phase of the Sun's 11-year cycle, data coming back from Orbiting Solar Observatory now will be compared with the intense activity of the nearest star as it again enters an intensely active period expected in 1980-82.

Besides looking at the Sun, the spacecraft's X-ray telescopes will be aimed at more than 100 pre-selected objects of special interest to astronomers, including supernova remnants (hot expanding clouds of cosmic debris that result from dying star explosions) and X-ray binary stars that seem to consist of a visible star and an invisible companion.

These companion stars may be highly condensed neutron stars or even black holes in space. A black hole is believed to form when a shrinking star's gravitational field intensifies to the point that no light or matter can escape. Gravitational force in a black hole is so great that New York City would fit into a teaspoon if it were composed of such dense material.

OSO-8, launched June 21 from Cape Canaveral, has been checked out by ground controllers at the Goddard Space Flight Center, and all experiments are functioning normally. The last experiment—an Extreme Ultraviolet Radiation experiment by the U.S. Naval Research Laboratory—was turned on June 25.

Prime contractor for the OSO-8 spacecraft is the Hughes Aircraft Co., El Segundo, CA; prime contractor for the Delta rocket booster is the McDonnell Douglas Astronautics Co., Huntington Beach, CA. The OSO program is managed for NASA's Office of Space Science by GSFC.

MSFC Holds Industry Briefings on Energy

The Marshall Space Flight Center conducted industry briefings July 1 and 8 on its role in the Energy Research and Development Administration's (ERDA) Solar Hearing and Cooling Demonstration Program.

The July 1 briefing was held in the Concert Hall of the Von Braun Civic Center at Huntsville, AL, and the July 8 meeting in the Crystal Ballroom of the Hacienda Hotel at El Segundo, CA.

MSFC planned to release requests for proposal (RFPs) during July for five initial efforts. They are: system development for single and multiple family residential and commercial applications; system development of available subsystems; additional development of proposed systems; additional development of proposed subsystems; and procurement of available solar heating subsystems, combined heating-cooling subsystems and hot water subsystems.

Hearth Named Langley Center Director

Donald P. Hearth

Donald P. Hearth, Deputy Director of the Goddard Space Flight Center, has been appointed Director of the Langley Research Center to replace Dr. Edgar M. Cortright, who has resigned from NASA to pursue other interests.

The appointment is effective Sept. 1, following the launch of the two Viking Spacecraft intended to reach Mars next year. Dr. Robert S. Cooper, Assistant Director for Defense Research and Engineering (Space and Advanced Systems), Office of the Secretary of Defense, will take over the post at GSFC vacated by Hearth.

"We are very fortunate to have someone with Don Hearth's capabilities and experiences to lead NASA's largest and first research center," Dr. James C. Fletcher, NASA Administrator, said. "His past accomplishments within NASA have been outstanding. He will be a great asset to Langley in directing the planning and conduct of programs and technology which are of major importance to the future of the agency."

Of Dr. Cortright's resignation, Dr. Fletcher said: "NASA will feel a great loss with the departure of Ed Cortright. He has made major contributions to the nation's aeronautics and space program for 30 years, while at two NASA Centers and at Headquarters in Washington.

"During the last seven years at Langley, Dr. Cortright has been the guiding factor for bringing the Viking mission from concept to launch. He has made major program redirections including expansion of the aeronautics program and the entrance of the Langley Center into pollution detection and monitoring from space, and has carried out a substantial facility modernization program at the Center."

Hearth has served at GSFC since 1970, providing day-to-day management of operations and serving as the principal official of the management of scientific and technical activities. Before accepting the position there, he served as Director of Planetary Programs in the Headquarters Office of Space Science and Applications, a position to which he was named after joining NASA in 1962 as Manager of Advanced Programs and Technology. Earlier, he had been Manager of Research on Hypersonic Propulsion and Flight Systems at Marquardt Corp., Van Nuys, CA. Prior to that, he was an aeronautical research scientist at the Lewis Research Center, under the National Advisory Committee for Aeronautics, NASA's predecessor.

Cooper has been serving in the Office of the Secretary of Defense since 1972. Earlier, he was at the Massachusetts Institute of Technology Lincoln Laboratory where he began as a staff member in 1966, working on problems related to ballistic missile discrimination and radar scattering from ionized wakes. He subsequently became group leader of the Laser Systems Group, moving up to Assistant Head of the Optics Division in 1971. Between 1958 and 1966, he was Assistant Professor of Electrical Engineering at MIT, specializing in electromagnetic waves with ionized gases.

Ford Notes MSFC's 15th Anniversary

"The Center's Achievements at the celebration of this milestone are of great historical significance."

So stated Presdent Ford in a message marking the 15th anniversary of the Marshall Space Flight Center, officially observed on July 1. It was a day in which business went on as usual and employees looked to the challenges ahead.

Here are other statements made by the President in his message addressed to Dr. William R. Lucas, MSFC Director:

"Congratulations and best wishes to you and to all the people of the Marshall Space Flight Center on its 15th anniversary of public service. * * *

"The dedicated team which was the Center's initial nucleus had already been responsible as members of the

MSFC'S 15th Anniversary—*David Newby (seated), NASA's first employee in Huntsville, recently made a special call on Dr. William R. Lucas, Marshall Space Flight Center Director, to reminisce in connection with the Center's 15th anniversary on July 1. Their discussion went back to the late 1950s, when Newby was the agency's liaison officer to the Army Ordnance Missile Command. He holds a model of the Huntsville-produced, Mercury-Redstone rocket that put the first American into space.*

predecessor U.S. Army Ballistic Missile Agency for the launching of the Free World's first satellite, Explorer.

"From its inception, the Marshall Center has continued in the forefront of this nation's tremendous advancement in the exploration of space. It provided the Redstone launch vehicle which placed the first American in space in Project Mercury, and the Saturn V launch vehicle which sent our astronauts on their epic voyages to the Moon in Project Apollo. It also played a major role in the Skylab space station which proved so valuable in pointing the way toward the untold potential of space research in helping to improve the quality of life on Earth.

"We look forward to more vital contributions such as these from the Marshall Center in the years ahead as the United States continues to lead the way in using space for the benefit of all mankind. I wish you Godspeed."

Ford Reviews NASA Programs in Annual Report to Congress

Expresses Gratification with Progress to Carry out Space Act of 1958

Activities during 1974 in both space and aeronautics were included as a part of the President's annual report to the Congress. His message transmitting it follows:

"I am pleased to transmit this report on the activities and accomplishments of the United States in aeronautics and space in 1974. This is in accordance with Section 206 of the National Aeronautics and Space Act of 1958, as amended (42 U.S.C. 2476).

"During 1974, the nation's activities in aeronautics and space continued to produce significant benefits, to experiment with and develop new applications, to increase scientific knowledge, and to advance technology. The report shows:

"The use of communications satellites continued to expand as a principal method of international communications. The first domestic privately owned communications satellites opened a new dimension in our telecommunications systems. Satellites continued to play an essential role in national defense activities—in communications, navigation, and other fields. Demonstration programs tested the use of satellite systems to improve delivery of health and education services.

"Experimental uses of Earth observation satellites were tested in crop surveys, pollution monitoring, land use planning, water resources management, and other fields. Weather satellites continued to be our chief source of both global and local weather data; a new geostationary satellite began continuous observation of weather affecting the Western Hemisphere.

"The Skylab manned space station mission was successfully completed; it demonstrated that human beings can survive and work well in space for months or more at a time and provided a store of new scientific and technical data on the Sun, Earth resources, medical effects of space flight, and other fields.

"Development of the Space Shuttle progressed on schedule, and within costs, toward the goal of a versatile reusable vehicle for routine and economical use of space at the end of the decade.

"Joint preparations and training with the Soviet Union proceeded for the 1975 Apollo-Soyuz manned docking experiment. Cooperative space activities with other nations continued on the basis of mutual benefits. Development by European nations at their expense of the Spacelab for use with the Space Shuttle got well underway.

"Exploration of the planets continued with

successful missions to Jupiter, Venus, and Mercury. The science of astronomy advanced with important new observations and discoveries using ground-based, high-altitude, and space telescopes.

"In aeronautics, good progress was made in developing technology to reduce energy requirements, noise and pollution of civil aircraft. Modernization of the air traffic control system continued with the introduction of semiautomated equipment for air route traffic control.

"Milestones in military aircraft development included the roll-out of the B-1 bomber, delivery of the first operational F-15 fighter aircraft, deployment to the fleet of the A-6E all-weather attack aircraft, and the successful testing of the new CH-53E helicopter.

"Transfer of aeronautical and space technology to other fields continued with many beneficial applications in energy, materials, transportation, medical care, and other areas.

"I believe that all Americans, and people of all nations, can be gratified with the accomplishments and the continued progress toward achieving the objectives of the National Aeronautics and Space Act of 1958 that are comprehensively described in this report."

Boeing to Study Space-Based Power Generating System

The Marshall Space Flight Center has awarded a $150,000 contract to The Boeing Co. for a 10-month study to determine the basic design, costs and environmental impact of potential power generation systems in space.

Boeing Aerospace Co. of Seattle will investigate the solar and nuclear families of space-based power generators, studying two different energy converters for each. One will be a thermal engine converter which transforms heat into a usable form of energy in much the same way as a steam turbine. The other will be a thermionic converter which produces electrically-charged particles to power a passive electrical generation system. Power generated at a satellite using either method would be transformed into microwaves which would then be beamed to Earth for reconversion into electricity.

Under the contract, Boeing is to define the satellites, study their costs and determine potential environmental effects. The contractor will also outline steps necessary to develop a power satellite system.

Teacher-Mathematician—*Miss Bettye L. Harrison, a professional mathematician at the Marshall Space Flight Center, is a Sunday School teacher who monitors an average of 20 computer programs at one time and says she loves every minute of it. She is assigned to the Engineering Systems Branch in the Computer Service Office and works with a variety of computer programs ranging from satellite data to vehicle structure and solar heating and cooling.*

Fellowship Students—*Engineering students at the Marshall Space Flight Center this summer under the National Aerospace Fellowship Program are shown with Marion Kent (standing second from left), Assistant Director for University Affairs. They are (seated left to right) Barbara Luckett, University of Texas, and Sherion McDaniel, Tuskegee Institute. Standing (left to right) are Fernando de la Fuente, University of Texas; Marion Kent; George Simms, Southern University, Scotlandville, LA; Riley Henderson, III, Tuskegee Institute; and Andy Carey, Southern University.*

Contracts Let for Materials Processing in Space

Three research and development contracts related to materials processing in space have been awarded by Marshall Space Flight Center to small businesses.

A Huntsville firm, Astro-Space Laboratories, Inc., was awarded a contract for $133,911. Scheduled to run for six months, it is for the fabrication, testing and delivery of two general purpose furnace systems, to be used in flight payloads for the Space Processing Rocket Experiment Project.

A contract of $441,472 was awarded to Artcor, Inc., Irvine, CA, for high temperature materials processing facilities for rocket payloads. It calls for the design, fabrication, testing and delivery of the facilities and will run for 25 months.

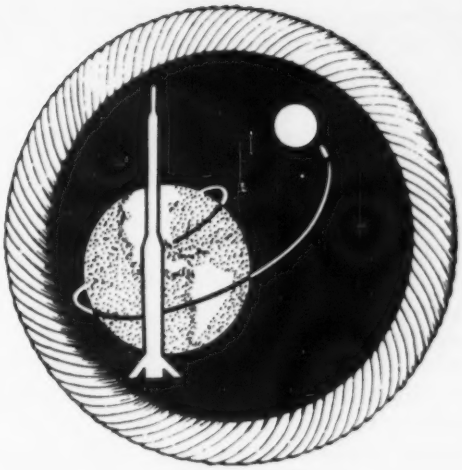
The third contract was awarded to J. S. Hetherington, Inc., Menlo Park, CA, and will run for 16 months at a cost of $120,781. It is for the design, fabrication, testing and delivery of one flight engineering model and two flight models of a transparent materials processing furnace system for the Space Processing Rocket Experiment Project.

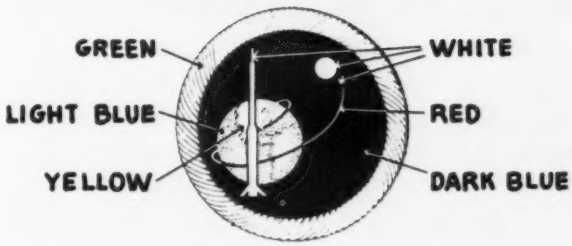
NASA-Developed Paint Tested on Golden Gate Bridge

An improved inorganic paint developed by Dr. John Schutt at the Goddard Space Flight Center has been applied to a six-foot steel panel mounted on the underside of the Golden Gate Bridge in San Francisco as a method of testing its qualities.

Unlike other inorganic paint which is difficult to apply, the NASA potassium silicate zinc-rich coating, having a silicon additive, sprays easily, features long protection and does not require a finish coat. It also provides corrosion protection from salt spray, fog, heat and the thermal shock of rapid temperature changes.

The Golden Gate test is expected to last for about two years. It is being conducted under the auspices of the NASA-sponsored Technology Application Team of the Stanford Research Institute as part of the agency's Technology Utilization Program.





Space Exploration Merit Badge—*This merit badge is now available to Boy Scouts of America. In order to earn it, a Scout must, among other things, write a 500-or-more-word report on the history of space exploration and plan and build a model of a space launch vehicle.*

Echo-Free Test Chamber at LeRC Studies Aircraft Noise Reduction

One of the largest echo-free test chambers in the country has been completed at the Lewis Research Center and is expected to aid in finding ways to reduce the piercing noise of jet airplanes.

Called the Engine Fan and Jet Noise Facility, it is the first all-weather indoor installation at LeRC able to test noise characteristics of quiet fans for advanced aircraft engines, as well as perform evaluation tests on new ways to reduce the rumble of jet nozzles.

Acoustic tests have shown that the facility can absorb essentially all sound in the region of interest for aircraft engine fan models up to 20 inches in diameter. Jet nozzles up to four inches in diameter also can be tested in it.

Mrs. Harris Honored—*Dr. George Jeffs, President of Rockwell International's Space Division, holds the 1974 CEYSAF (Cultural Economic Youth Sports Academic Foundation) Achievers Award presented Mrs. Ruth Bates Harris, (left) NASA Deputy Assistant Administrator of Public Affairs for Community and Human Relations, during observance of Afro-American History Month. She was elected to receive the tribute as "the most dynamic Black Woman in industry" for demonstrating "exceptional courage in becoming a driving force in seeking avenues to human dignity."*

Multiplexer Contract Awarded by MSFC

The Marshall Space Flight Center has awarded a $5,768,612 contract to Sperry Flight Systems, Sperry Rand Corp., Phoenix, AZ, for Space Shuttle hardware.

The contract calls for design, development, test and delivery of 37 multiplexers/demultiplexers (MDM) for Space Shuttle Solid Rocket Boosters and for three automatic test sets.

The MDM is an electronic device which makes it possible to send or receive more than one (multiple) message, signal or unit of information on a single communication channel.

Significant Role Assigned MSFC in NASA/ERDA Agreement

A significant role has been assigned the Marshall Space Flight Center in near-term development for the demonstration program of the Energy Research and Development Administration's (ERDA) National Plan for Solar Heating and Cooling.

The assignment resulted from the interagency cooperative agreement recently signed by Dr. James C. Fletcher, Administrator of NASA, and Dr. Robert C. Seamans, Jr., ERDA Administrator. Outlining NASA's role in support of the National Energy Program, it represents months of planning by the two agencies and the beginning of a concentrated effort to solve the nation's energy problems.

MSFC will direct a development program in support of ERDA's Solar Heating and Cooling Demonstration activities leading to the early, widespread, practical application of solar energy for heating and cooling of buildings, both residential and commercial.

The scope of the planned effort at MSFC in support of ERDA during the next five years is expected to total more than $50 million. Center officials estimate that about 100 persons may be involved in the program.

A Task Team has been organized within the Program Development Directorate at MSFC, and Dr. William R. Lucas, Center Director, has appointed Donald R. Bowden as Manager of the team.

Radio-Television

(*Released Nationally*)

AUGUST

TELEVISION: Two color film releases in the *Aeronautics and Space Report* monthly series (4½-min and 90-sec. versions): "From Kites to Wings"—Rogallo wing story.

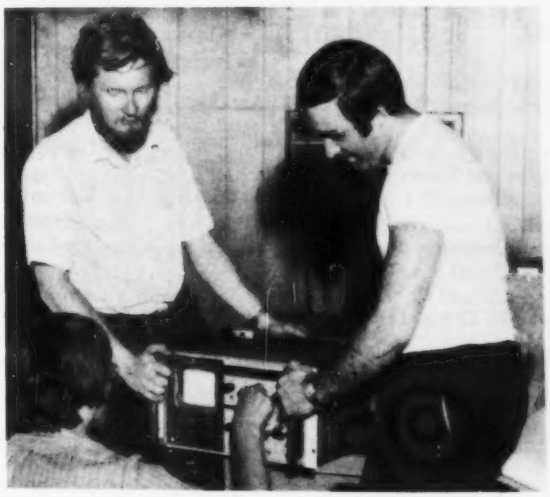
RADIO: Four weekly *Space Story* programs have been released: "Viking Missions to Mars," (LaRC/Martin); "Viking-Mars Life Search," (LaRC/Soffen); "Dr. Carl Sagan on Viking," (Cornell U./Sagan); and 'Solar Heating and Cooling," (MSFC/G. von Tiesenhausen. (One monthly *NASA Special Report*, "Viking Missions to Mars," (LaRC/Martin and Soffen). One set of ten 60-second announcements, NASA Space Notes, will be released.

Headquarters Press Releases

(Issued by the Public Information Division, Code FP, Headquarters, Washington DC 20546. These releases are available only to members of the news media.)

75-183 Viking A and B Press Kit
75-184 NTE/KSC PIO Temporarily Moves to Cape Canaveral
75-185 Technical Seminar to Be Held in Boston
75-186 Wind Energy Bibliography Published
75-187 New Experiments Invited for Third Year of ATS-6
75-188 NASA Employee Awarded Woodrow Wilson Fellowship
75-189 Pioneer 10 Is in Good Health After All
75-190 NTE/Viking News Conference Set for July 12 in Florida
75-191 No Interference Between Soyuz 18/Salyut 4 and Apollo Soyuz Flights, Technical Directors Agree
75-192 Liquid Hydrogen Contract Awarded to Pennsylvania Firm
75-193 NTE/Press Briefing Scheduled Preceding Apollo Soyuz Launch
75-194 ATS-6 Now on Station in View of India—Anomaly Being Studied
75-195 ASTP Sighting Information Available at NASA News Centers
75-197 Newest Weather Satellite Working Well
75-198 Hydrogen Injection Engines for General Aircraft
75-199 M-2 Lifting Body Arrives at Smithsonian
75-200 American, Soviet Experiments on ASTP to Study Fish
75-201 Aerial Surveys Show Fuel Waste by Individual Homes
75-202 Crystal Growth Experiment to Be Performed During ASTP
75-203 Soviet Experiment on Metals Melting Set for ASTP
75-204 Final Saturn Launch to Signify End of Era
75-205 Griffin, Allen Get New NASA Assignments
75-206 Solar Cell Material to Be Listed During Apollo Soyuz
75-207 Practical Automated Controls for Small Airplanes Studied
75-208 Hearth Named New Langley Center Director
75-209 NASA Awards $5.5 Million Contract for Large Infrared Telescope
75-210 Viking Leaders Gather in Florida
75-211 NASA Scientist Zeroing in on Cosmic Rays
75-212 Echo-Free Test Chamber Studies Aircraft Noise Reduction
75-213 NASA-Developed Paint Tested on Golden Gate Bridge
75-215 NTE/Cape Canaveral News Center Operates for Viking Launches
75-216 Viking Is "Go" for August 11

New FRC Procurement Head—*Lawrence W. Rucker, formerly Deputy Chief of Procurement and Chairman of the Procurement Committee at Edwards Air Force Base, has been named Director of the Procurement and Supply Division at the Flight Research Center. A member of the U.S. Air Force from 1950 to 1955, he holds a degree in Business Administration from Golden Gate University in San Francisco.*



Laser Doppler System—*An experimental Scanning Laser Doppler System (SLDS) designed by engineers at the Marshall Space Flight Center for use in detecting and monitoring aircraft wake vortices, was recently returned there from the John F. Kennedy International Airport in New York City where it has been involved in field tests. Jim Bilbro (standing, left), Project Engineer for the SLDS, is shown inspecting some of the components. With him are Ed Gorzynski (kneeling) and Bob Howle, both of Lockheed Missiles and Space Co.*

NASA Tech Briefs

The Technology Utilization Office, NASA Headquarters

The following is a listing of published NASA Tech Briefs. Inquiries concerning them should be directed to the TU Office of the originating NASA Center.

Innovator(s)	Title	Number	Center
John W. Stuart and John H. Henninger, GSFC	Integrating-Sphere Coating	B73-10403	GSFC
Bill A. Williams, ARC, and William Elkins, Aerotherm Corp.	Liquid-Cooled Liner for Helmets	B74-10249	ARC
Paul R. Caron, Electronics Research Center	Logarithmic-Function Generator	B74-10285	NaPO
Siegfried O. Auer, National Academy of Science	Micrometeoroid Velocity-and-Trajectory Analyzer	B74-10286	GSFC
Siegfried O. Auer, National Academy of Science	Micrometeoroid Composition Analyzer	B74-10387	GSFC
James S. Ajioka, George I. Tsuda and William A. Leeper, Hughes Aircraft Corp.	High-Efficiency Multifrequency Feed	B74-10288	GSFC
Bruce A. Nelson, Martin Marietta Corp.	Micro-Organism Distribution Sampling for Bioassays	B74-10289	LaRC
Morriss L. Holliday, LaRC	Alinement Fixture for Precising Cutting of Printed-Wiring Boards	B74-10290	LaRC
Renaldo V. Jenkins and Alexander P. Sabol, LaRC	Flat Device for Heat Concentration or Dispersion	B74-10291	LaRC
L. A. Hein and W. N. Myers, MSFC	Mechanical Solar Motor: A Concept	B74-10292	MSFC
W. C. Stewart, RCA Corp.	Acoustic-Optic Deflector Telescope	B74-10293	MSFC
F. J. Gamari and J. L. Moresi, Sprague Electric Co.	Improved Fabrication of Electrolytic Capacitors	B74-10294	MSFC
Philip A. Clements, Caltech/JPL	Stable Group Delay Cable	B74-10295	NaPO
George C. Gilley, Caltech/JPL	High-Speed Fault-Tolerant Telemetry/ Computer Interface	B74-10296	NaPO
Robert H. Silver and Sarkis H. Kalfayan, Caltech/JPL	Strain Gauge Sensitivity Improved by Using a Composite Beam	B74-10297	NaPO
Edgar F. Koch, Caltech/JPL	Remotely Operated Gas-Pressure Regulator and Shutoff Valve	B74-10398	NaPO
Albert Topits, Jr., Caltech/JPL	Apparatus for Heat Treating Plastic Belts	B74-10299	NaPO
G. R. Hansen, Jr., Caltech/JPL	Location of Vehicles Using AM Station Broadcasting Signals	B74-10300	NaPO
Mokhtar A. Salama, Wallace J. Rowe and Robert K. Yasio, Caltech/JPL	Thermoelastic Analysis of Solar Cell Arrays and Their Material Properties	B74-10301	NaPO
R. Steinberg, D. L. Alger and D. W. Cooper, LeRC	A Superior Process for Forming Titanium Hydrogen Isotopic Films	B75-10001	LeRC
R. F. Jocke and R. E. Miller, LeRC	Low-Cost, Portable Fire Hose Tester	B75-10003	LeRC
D. J. Poferl and R. Svehla, LeRC	Properties of Air and Combustion Products of Fuel with Air	B75-10004	LeRC
John H. Dircus, LeRC	Computer Program to Generate Engine Inlet Flow Contour Maps and Distortion Parameters	B75-10005	LeRC
F. G. Arcella and G. A. Lessman, Westinghouse Astronuclear Laboratory	Inhibiting Kirkendall Void Growth in Welded Bimetallic Structures	B75-10006	LeRC
John G. Ewashinka, LeRC	Lightweight Protective Clothing for the Safe Handling of High Intensity Pressurized Lamps	B75-10007	LeRC
Grant W. Coon, ARC	Trielectrode Capacitive Pressure Transducer	B75-10025	ARC
Maxwell B. Blanchard, ARC, Robert Greeley, University of Santa Clara and Robert Goettelman, LFE Corp.	Remote Estimation of Soil Moisture	B75-10026	ARC
Robert L. Altman, ARC	Method for Evaluating Effectiveness of Dry Fire-Extinguishing Chemicals	B75-10027	ARC
Michael Deluca, Ohio State University	Study of Fluid Flow by Charged Particles	B75-10028	ARC
Leslie D. Montgomery, ARC	Analytic Model for Assessing Thermal Performance of SCUBA Divers	B75-10029	ARC
Jaime Miquel and Paul R. Lundgren, ARC, and Klaus G. Bensch, Stanford University School of Medicine	Acceleration of the Aging Process by Oxygen	B75-10030	ARC

Lawrence E. Dickens, Westinghouse Electric Corp.	Varactor Diode Assembly with Low Parasitic Reactances	B75-10031	GSFC
Clifton E. Jackson, Jr., and Edward F. Puccinelli, GSFC	View Factor Computer Program (VIEW)	B75-10032	GSFC
C. Wrandle Barth, GSFC	Extensive Set of Macros for Structured Programing in OS/360 Assembly Language (STRCMACS)	B75-10033	GSFC
Joseph S. Heyman and F. Dale Stone, LaRC; and Mark S. Conradi and James G. Miller, Washington University	Transmission Oscillator Ultrasonic Spectometer (TOUS): A New Research Instrument	B75-10035	LaRC
B. K. Ballard, RCA Corp.	Interface Control Scheme for Computer High-Speed Interface Unit	B75-10036	MSFC
C. B. Lory, The Charles Stark Draper Laboratory, Inc.	Fill-in Binary Loop Pulse-Torque Quantizer	B75-10036	MSFC
K. A. Reynard and A. H. Gerber, Horizons Research, Inc.	Curable Polyphosphazenes	B75-10038	MSFC
W. J. Patterson, MSFC	Improved Printed-Wiring Boards for High-Reliability Circuits	B75-10039	MSFC
W. L. Casey, et al, Martin Marietta Corp.	Viewfinder/Tracking System for Skylab	B75-10040	JSC
R. L. Coleman, Orion Research Inc.	Portable Automatic Blood Analyzer		
Lockheed Missiles and Space Co.	High-Temperature, Reusable Surface Insulation System	B75-10041 B75-10042	JSC JSC
Space Optics Research Laboratories	Refracting Lens System Low-Scatter Star-Tracker: A Concept	B75-10043	JSC
J. F. Charles, Rockwell International Corp.	High-Strength Rivet Does Not Require Aging	B75-10044	JSC
Vilhelm J. Jahnsen, Caltech/JPL	Improved Extraction Technique for Biological Fluids	B75-10045	NaPO
John E. Ohlson and William F. Williams, Caltech/PL	Multibeam-Antenna Feed System to Isolate Orthogonally Polarized Beams	B75-10046	NaPO
Momtaz N. Mansour, Carl P. Chapman and Harold L. Wayland, Caltech/JPL	Automatically-Focusing Microscope System for Live Tissue Observation	B75-10048	NaPO
Robert F. Dillon, Martin Marietta Corp., and Robert C. Mayne, Caltech/JPL	Shock and Vibration Isolation Mount for Small Electronic Components	B75-10049	NaPO
Taylor G. Wang, Melvin W. Saffren and Daniel D. Elleman, Caltech/JPL	Resonant Chambers for Suspending Material in Air	B75-10050	NaPO
Cyril Feldstein, Jules V. Osher, Gilbert W. Lewis, Robert H. Silver and Edward N. Duran, Caltech/JPL	Subminiature Transducers for Measuring Forces and Deformations of Heart Muscle	B75-10051	NaPO
Gerald S. Perkins, Caltech/JPL	Gas Bearing Operates in Vacuum	B75-10052	NaPO
Sheldon Weinstein, Caltech/JPL	JPL Transient Radiation Analysis by Computer Program (JTRAC)	B75-10053	NaPO
Anthony Giandomenico, Caltech/JPL	Low-Cost Tool Set for Removing Brazed Fittings	B75-10054	NaPO

Inventions and Contributions Board Monetary Awards

The Inventions and Contributions Board, at its meetings of June 27, July 22 and August 29, 1974, recommended that monetary awards be granted to the NASA employees and the NASA contractor employees identified on the attached list for scientific and technical contributions to space and aeronautical activities. The recommendations were approved by the Administrator and the awards have been made.

Innovator(s)	Title of Invention and Contribution
AMES RESEARCH CENTER	
Theodore Wydeven	Protection of Moisture Sensitive Optical Components
FLIGHT RESEARCH CENTER	
Allen Klommhaus	YF-12 Engine Ejector Fillets

GODDARD SPACE FLIGHT CENTER

H. Edward Rowe Dominick Santarpia	A Dually Mode-Locked Nd: YAG Laser
Leonard L. Kleinberg	Ultra-Stable Oscillator
James H. Underwood	Multiple Focusing Collinator

JOHNSON SPACE CENTER

Donald C. Cheatham Richard Reid	Spacecraft Docking and Alignment System
Dr. John Rummel Ed Michel	Metabolic Analyzer

LANGLEY RESEARCH CENTER

Charles W. Whitehead	Apparatus for Inserting and Removing Specimens from High Temperature Vacuum Furnaces
Carl V. Rumble	Adjustable Frequency Response Microphone
Leonard M. Weinstein	Contrast Enhancement and Small Detail Blending of Photographic Images
George M. Wood, Jr. Charlie E. Dameron	Instrument for Two-Dimensional Plotting
Howard B. Miller	Convert—A—Compass
William M. Haraway, Jr. Walter J. Dale Edwin A. McErlean	Improved Bonding Method in Manufacture of Continuing Regression Rate Sensor Devices
Alexander P. Sabol	Heat Exchanger System and Method
George M. Dudley	Mono-Page Distribution
Charles W. McKee	Fluid Control Apparatus and Method
Howard W. Stone, Jr.	Wing Upper Surface Flap
Ernest E. Burcher Daneld J. Jobson Stephen J. Katzberg W. Lane Kelly, IV	A Spectrometer Integrated with a Facsimile Camera
Archibald R. Sinclair Ernest E. Burcher Stephen J. Katzberg	Automatic Focus Control for Facsimile Camera
Willard S. Blanchard, Jr. Joseph L. Johnson, Jr.	High Lift Aircraft
Judd R. Wilkens Stacy M. Mills	Automatic Microbial Transfer Device
Dr. Johnson H. Painter	Anti-Multipath Digital Signal Detector
William E. Zorumski	Noise Suppressor
Albert Philips	Technique for Positioning and Locating Orifice Tubes

MARSHALL SPACE FLIGHT CENTER

Raymond L. Gause	Ergometer Calibrator
Wilhelm Angele	Cryogenic Gyroscope Housing
Dan H. Dane	Orthotic Arm Joint
John F. Hamlet	Stable Supply Oscillator
Charles L. Wyman Thomas L. Howe	Strain Gauge Ambiguity Sensor for Segmented Mirror Active Optical System
Richard B. Hoover	Multiple Focusing Collimator
William L. Ray	Remote Fire Stack Igniter
Gabriel R. Wallace	Pseudo-Noise Test Set for Communication System Evaluation
Cortez L. Perry	Metabolic Analyzer

BROOKHAVEN LABORATORIES

Carl R. Flatau	Control System for Shuttle Remote Manipulator System

E. I. DuPONT deNEMOURS & COMPANY

Robert D. Boies	Instrument for Two-Dimensional Plotting

GTE, SYLVANIA

Henning C. Swenson, Jr.	Balloon-Borne Differential Temperature Sensor and Transmission System

HAMILTON-STANDARD DIVISION, UNITED AIRCRAFT

Raymond B. Trusch, Edward W. O'Connor — Condensate Removal Device for Heat Exchangers

JET PROPULSION LABORATORY

Hubert Erpenbach — Method of Producing Storage Bulb for an Atomic Hydrogen Maser
Paul Alexander, Arthur J. Murphy, Jr. — Disconnect Unit
Dr. Christopher England — Zinc-Halide Battery with Molten Electrolyte
George M. Simmons — Solid Propellant and Method of Preparation
John I. Schafer — Solid Propellant
Robert A. Rhein — Process for Producing Curable Liquid Hydrocarbon Prepolymers
Charles Elachi — Acoustically Controlled Distributed Feedback Laser
Mario Stevens — Gas Chromatograph
George R. Hansen — Vehicle Locating System Utilizing AM Broadcasting Station Carriers

MARTIN MARIETTA CORPORATION

Shepard B. Brodie, Frederick J. Greeb — Control System for Shuttle Remote Manipulator System
Geir Hauge, Christ W. Pederson — Low Distortion Automatic Phase Control Circuit

McDONNELL DOUGLAS CORPORATION

George P. Kazokas — Vacuum Leak Detector

NATIONAL ACADEMY OF SCIENCES

Dr. Erwin S. Hochmair — Integrated Power Gyrator
Dr. Erwin S. Hochmair — Integrated, Single-Channel-Type FET Gyrator
John R. Hollahan — Protection of Moisture Sensitive Optical Components

NATIONAL RESEARCH COUNCIL

Dr. John Osmundson — A Dually Mode-Locked Nd: YAG Laser

RADIATION, INCORPORATED

Charles W. Kurvin — Remote Platform Power Conserving System

SPERRY RAND CORPORATION

Glenn D. Weathers, Sidney S. Gussow — Pseudo-Noise Test Set for Communication System Evaluation

WESTINGHOUSE ELECTRIC CORPORATION

Lawrence E. Dickens — Millimeter Wave Pumped Parametric Amplifier

Patents for Inventions from NASA Research

The Office of General Counsel, NASA Headquarters, announces that the following U.S. patents have been issued by the U.S. Patent Office to NASA for inventions resulting from NASA research. Inquiries concerning them should be directed to the attention of the NASA Patent Counsel for the indicated installation.

Inventor(s) and Employer(s)	Title and NASA Docket	Patent No.	Installation
Siegfried O. Auer, National Academy of Sciences, Washington, DC	Impact Position Detector for Outer Space Particles (GSC-11,829-1)	3,891,851	GSFC
John Dimeff, NASA/ARC	Tachometer Circuit (ARC-10,603-1)	3,891,925	ARC
John C. Evans, NASA/LeRC	High Power Laser Apparatus and System (XLE-2529-2)	3,894,289	LeRC
Felix P. Laiacona, NASA/MSFC	Graphite-Reinforced Aluminum Composite and Method of Preparing the Same (MFS-21,077-1)	3,894,677	MSFC

Shepard B. Brodie, Carl R. Flatau and Frederick J. Greeb, Martin Marietta Corp., Denver, CO	Variable Ratio Mixed-Mode Bilateral Master-Slave Control System for Shuttle Remote Manipulator System (MSC-14,245-1)	3,893,573	JSC
Robert J. Naumann, NASA/MSFC	Carbon Monoxide Monitor (MFS-22,060-1)	3,895,912	MSFC
Robert D. Lee, Robert J. Hudock and Dale I. Shute, NASA/ARC	Reference Apparatus for Medical Ultrasonic Transducer (ARC-10,753-1)	3,893,449	ARC
Alexander S. Irons, Paul P. Muehter and Willie D. Kent, Caltech/JPL, Pasadena, CA	Heat Sterilizable Patient Ventilator (NPO-13,313-1)	3,893,458	NaPO
James C. Howard, NASA/ARC	G-Load Measuring and Indicator Apparatus (ARC-10,806-1)	3,895,521	ARC

Projected Launch Schedule

(As of July 24, 1975)

Name	Launch Date	Vehicle	Range	Mission Remarks
ESA-COS-B	Aug. 7	Delta	WTR	European scientific satellite to study extraterrestrial gamma radiation. Reimbursable.
Viking-A	Aug. 11	TIII-Centaur	ETR	Planetary mission to explore Mars from orbit around the planet and with a capsule on its surface.
Symphonie-B	Aug. 14	Delta	ETR	Second joint French/German experimental communications satellite designed for TV, telephone, and data transmission. Reimbursable.
Viking-B	Aug. 21	TIII-Centaur	ETR	Planetary mission to explore Mars from orbit around the planet and with a capsule on its surface.
Intelsat IVA-A	Sept. 11	A-Centaur	ETR	First of a series of improved Intelsat Consortium satellites that will have almost double the capability of the present Intelsat IV satellites. Reimbursable.
Marisat-A	Sept. 18	Delta	ETR	Comsat Corp. satellite to provide maritime satellite communications services. Reimbursable.
Navy	Sept. 25	Scout	WTR	Navy navigation satellite. Reimbursable.
Atmosphere-D	Sept.	Delta	WTR	A scientific satellite to investigate the chemical processes and energy transfer mechanisms which control Earth's atmosphere.
SMS-C (GOES-A)	Oct.	Delta	ETR	First operational synchronous meteorological satellite of the National Weather Service of the Department of Commerce to provide continuous day and nighttime global cloud cover observations.
Marisat-B	Oct.	Delta	ETR	Second Comsat Corp. satellite to provide maritime satellite communications services. Reimbursable.
Atmosphere-E	Nov.	Delta	ETR	A scientific satellite to investigate the chemical processes and energy transfer mechanisms which control Earth's atmosphere.
ITOS-E2	Nov.	Delta	WTR	Operational meteorological satellite of the National Weather Service to provide daytime and nighttime cloud cover imagery. Reimbursable.
Dual Air Density	Nov.	Scout	WTR	Two scientific spacecraft will be placed in orbit to obtain simultaneously measurements of the composition of upper and lower levels of atmosphere.
Helios-B	Dec.	TIII-Centaur	ETR	Second West German/NASA cooperative satellite to investigate the properties and processes in interplanetary space close to the Sun.
Intelsat IVA-B	4th Qtr.	A-Centaur	ETR	Second of a series of improved Intelsat Consortium satellites. Reimbursable.
RCA-A	4th Qtr.	Delta	ETR	First of a series of domestic communications satellites for RCA. Reimbursable.

1976

CAS-C/CTS	Jan.	Delta	ETR	Canadian-US cooperative experimental communications satellite to develop and test the technology of high power satellite communications systems.
Relativity (Gravity Probe)	(Under study)	Scout	WI	Scientific satellite to make a test of Einstein's Theory of Relativity.
RCA-B	1st Qtr.	Delta	ETR	Second domestic communications satellite for RCA. Reimbursable.
NATO-C	1st Qtr.	Delta	ETR	Communications satellite in synchronous orbit to perform communications relay for NATO. Reimbursable.
LAGEOS	1st Qtr.	Delta	ETR	Demonstrate relevant space techniques that will contribute to the development and validation of predictive models for earthquake hazard alleviation, ocean surface conditions and ocean circulation.
Comstar-A	1st Qtr.	A-Centaur	ETR	Domestic communications satellite for Comsat Corp. Reimbursable.
Intelsat IVA-C	1st Qtr.	A-Centaur	ETR	Third of a series of improved Intelsat Consortium satellites. Reimbursable.
Westar-C	(Under study)	Delta	ETR	Backup domestic communications spacecraft for Western Union. Reimbursable.
Comstar-B	1st Qtr.	A-Centaur	ETR	Second domestic communications satellite for Comsat. Reimbursable.
ESA-GEOS	2nd Qtr.	Delta	ETR	ESA spacecraft to support space applications geoscience experiments in ocean topography measurements and solid Earth physics. Reimbursable.
Marisat-C	2nd Qtr.	Delta	ETR	Comsat Corp. satellite to provide maritime satellite communications services. Reimbursable.
RCA-C	2nd Half	Delta	ETR	Third domestic communications satellite for RCA. Reimbursable.
Indonesia-A	3rd Qtr.	Delta	ETR	Indonesian communications satellite. Reimbursable.
SIRIO-A	3rd Qtr.	Delta	ETR	Italian project to investigate radio propagation, trapped radiation flux, magnetic field intensity and variation, and the primary electron energy spectrum. Reimbursable.

Are you getting your **1 cent** worth from **NASA**?

For a penny of your tax dollar, you are getting, among other things

The Rogallo Wing for Hang Gliding

A boyhood love for kite-flying and NASA's desire to find devices capable of bringing spacecraft safely back to Earth have resulted in the development of what the aerospace industry calls the Rogallo Wing, a broad class of fabric or membrane lifting surfaces that provides more lift than drag in gliding or powered flight.

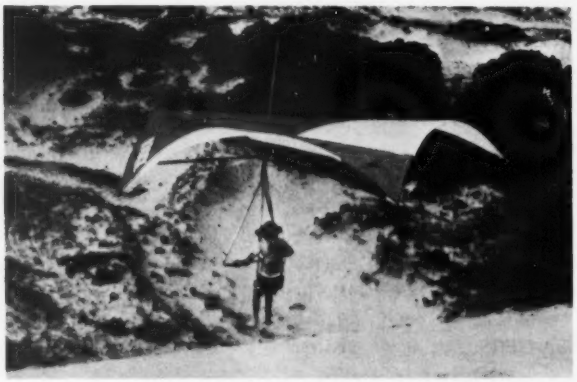
Used largely at present for gliding off mountain tops and high slopes, the potential benefits of the wings are classed as innumerable. It is estimated there are 20,000 hang gliders in the world today, some of them having remained aloft for 15 hours and reached altitudes of 15,000 feet. Proponents foresee them transporting people, vehicles and cargoes to inaccessible areas and doing many other things not possible with conventional craft.

Their development dates back to the days when NASA was NACA (the National Advisory Committee for Aeronautics), to a period shortly after World War II. The kite-lover was Francis Rogallo, a Stanford University graduate in aeronautics who had gone to work for the Langley Laboratory (now Langley Research Center). His boyhood kite-flying had been done in the Coast Range Mountains of California.

In 1945, unable to encourage Langley to return to work on private owner-type aircraft, he took up the pursuit himself, aided by his wife and family. One of his ideas led him to try to develop a wing that could be folded into a small package.

By 1948, they had developed and applied for a patent on a good performing, completely flexible wing. In 1958, the Russians launched Sputnik I, and Rogallo immediately had company—the newly-formed NASA and the U.S. Army. Something must be found to bring astronauts and space vehicles back to Earth safely. His wing came in for considerable tests at Langley and elsewhere, and improvements followed.

Rogallo says there are many potential uses for flexible wings in astronautics—and not just in gliding from hills or mountains to lower elevations.



He thinks gliders will be developed that will be almost as easy to carry as a pair of snow skis. It has been demonstrated that cargo and equipment can be released at altitude and radio-controlled to a chosen landing point. In the air, weight is not limited by the capacity of roads and bridges; size is not restricted by clearance through tunnels, bridges and overpasses; directions followed can be up or down, as well as left, right, frontward or backward.

In 1970, Rogallo retired from NASA as Head of the Low Speed Vehicles Branch. He now lives at Kitty Hawk, NC, where, as shown in the photograph, he continues to hang glide. He still is interested in wind research.

"After years of study and experiment with flexible wings," he says, "I have come to the conclusion that many things that can be done with rigid wings or parachutes can be done better with flexible wings. Flexible wings are a new, important, and fascinating field of aerospace research."

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